

ACKNOWLEDGEMENTS

HPCL and Oil Field Teknics are extremely thankful to the Chairman, Members, and all the officials of the Karnataka State Pollution Control Board, Bangalore for granting permission to undertake this Bio-Remediation method for 10 Kilolitres of Sludge.

REPORT ON BIO REMEDIATION OF OIL BEARING SLUDGE

**HINDUSTAN PETROLEUM CORPORATION LTD.,
DEVANAGONTHI INSTALLATION**



OIL FIELD TEKNIKS

REPORT ON BIO REMEDIATION OF OIL BEARING SLUDGE

submitted to the
Karnataka State Pollution Control Board

Industry
**HINDUSTAN PETROLEUM CORPORATION LTD.,
DEVANAGONTHI INSTALLATION
BANGALORE 560067**

Consultants

OIL FIELD TEKNIKS



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Objective

Trial Bio-remediation of 10 Kilolitres of low oil content sludge, retrieved from tank bottom and stored in sealed barrels. To bring down the Oil & Grease percentage to permissible limits.

Date of initiation : 13th March 2006

Date of completion : 31st July 2006

Method

Enhanced Bio Remediation using natural bacteria on site

Results

Contaminant	Before Treatment	After Treatment
Oil & Grease	9.12%	1.4%
Lead	11 ppm	nil
Vanadium	2 ppm	nil
Arsenic	1.50 ppm	nil
Mercury	0.90 ppm	nil
Nickel	12.50 ppm	3.42 ppm
Cobalt	BDL	BDL
Cadmium	BDL	BDL

*Laboratory Analysis reports attached

PROJECT OPERATIONS

Preparation of Bio-remediation Pit



HPCL has earmarked the Bio remediation site, outside the tank farm, at the corner of the installation. The Sludge pit was prepared by HPCL using their internal resources. It was arrived that, for treatment of 70kilo litres of sludge, a pit ad measuring 15mtrX15mtrX0.6mtr is necessary. Accordingly a pit with these dimensions has been prepared, the debris and stones were removed. A tractor was used for leveling the surface of the pit. Fresh soil (clay) was sprinkled on the leveled surface to the height of 6inches.

Transportation of Sludge barrels



As per the instructions of Karnataka State Pollution Control Board, the quantity 10kilolitres is ear marked for the trial. Since the sludge is stored in barrels, a convenient method of transporting the barrels to the pit has been taken up by a ramp in one corner. By this method, all the 50 barrels were rolled inside the pit manually. Since these barrels were sealed, there was no leakage at any place on the way.

Transferring Sludge inside the pit



An internal boundary was marked for 2mtrX15mtrs, in order to accommodate the 10kilolitres of sludge, thus making a small pit. The sludge from each barrel has been transferred inside the small pit.

Levelling of Sludge inside the pit



The sludge which was dumped from the barrels has been evenly distributed through out the pit with the help of crowbars, and long handle shovels. After this process, the sludge was levelled, and was made ready for Bio-remediation.

Spraying Bio enzyme solution



After the leveling of the sludge fresh soil (clay) was sprinkled on the surface of the sludge through out the pit, upto a height of 2 inches. This was mixed thoroughly by manual process using long crowbar, so that the sludge and soil mixture is formed.

A solution of SOLPAR and water at 12Ltrs:188Ltrs was prepared in an empty barrel. Two kilos of a nutrient name REM-B was dissolved in this solution.

This solution was evenly sprayed all over the pit with the help of a 0.5HP motor pump.

2 weeks after the 1st spray



It is highly essential to maintain moisture in the pit. Hence spraying of water was consistently done on a daily basis. A dosage of 100 litres water spray in the morning and 100 litres in the evening was maintained, on the surface of the sludge through out the pit to keep the sludge wet.

After completion of two weeks, a 2nd treatment with a solution of 12 litres SOLPAR and 188 litres water was given. Two kilograms of nutrient named REM -B was added. This mixture was sprayed as earlier ensuring that the entire sludge has completely drenched. The wet sludge was now ready for bacterial action.

2 weeks after the 2nd spray



The sludge which underwent two phases of treatment already showed a marked difference in colour and odour. No odour was traceable and top colour was changed to almost like soil. The consistency of the sludge also was changed. The sludge became breakable with fingers unlike earlier, which was soggy.

3 weeks after the 3rd spray



It is noticed that the almost soil like sludge retains water and absorbs it, unlike earlier when water used to slip over the sludge to the sides owing to the nature of hydrocarbons. Now that there are no hydrocarbons left and the sludge got converted to almost like soil, the properties have accordingly changed and the permeability and the porosity of the remediated sludge were akin to that of soil.

The above picture shows the remarkable change that came over from the original sludge. At this stage, the percentage of oil and grease has come down to 1.4% and the concentration of heavy metals has been reduced to below detectable levels. This bio mass after receiving rain for a season, will enrich itself completely as a manure. A comparative picture has been included at the later part of the report for comparison of sludge before and after treatment.

LABORATORY REPORTS



CERTIFICATE OF ANALYSIS

MoEF Regd.No: D.L-33004/99

M/s. Hindustan Petroleum Corporation Limited Devanagonthi Installation Near Railway Station Bangalore - 560067	Analytical Ref. No. : SUEM06-146
	Customers Ref. No : E/HP/BL/11
	Date of receipt : 28.03.2006
	Analysis completed on : 01.04.2006

MONITORING / SAMPLE DETAILS :

Name of The Sample : HPCL Bangalore Sludge Location : NA

Analysis required for : % Oil & Grease, Lead, Vanadium, Arsenic, Mercury, Cadmium, Nickel, Cobalt

Sno.	Tests	Limits / Specification	Result
1	Oil & Grease (%)	--	9.12%
2	Lead (ppm)	--	11.00ppm
3	Vanadium (ppm)	--	2.00ppm
4	Arsenic (ppm)	--	1.50 ppm
5	Mercury (ppm)	--	0.90 ppm
6	Cadmium (ppm)	--	BDL
7	Nickel (ppm)	--	12.50ppm
8	Cobalt	--	BDL

Remarks: Analysed as per IHS on as is basis

Analyst: *[Signature]* 01.04.06
 Authorised Signatory: *[Signature]* 01.04.06

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StarTech Labs Pvt. Ltd., 2nd Floor, SMR Chambers, H.No.1-58/7, Opp. St. Ann's Jr. College, Madina Guda, Seril Lingampally,
 Hyderabad - 500 050. Phone : 040-23041900, Tel/Fax : 040-23041905, Website : www.startechlabs.com



TEST REPORT

MoEF Regd.No: D.L-33004/99

M/s. Hindustan Petroleum Corporation Limited Devanagonthi Installation Near Railway Station Bangalore - 560067	Analytical Ref. No. : SUEM06-490
	Customers Ref. No : NA
	Date of receipt : 26.07.2006
	Analysis completed on : 28.07.2006

MONITORING / SAMPLE DETAILS :

Name of The Sample : Soil Sample Location : HPCL Bangalore

Analysis required for : % Oil & Grease, Lead, Vanadium, Arsenic, Mercury, Cadmium, Nickel, Cobalt

Sno.	Tests	Limits / Specification	Result
1	Oil & Grease (%)	--	1.4%
2	Lead (ppm)	--	NI
3	Vanadium (ppm)	--	NI
4	Arsenic (ppm)	--	BDL
5	Mercury (ppm)	--	NI
6	Cadmium (ppm)	--	NI
7	Nickel (ppm)	--	3.40ppm
8	Cobalt (ppm)	--	BDL

Remarks: Analysed as per IHS on as is basis

Checked by: *[Signature]* 28.07.06
 Authorised Signatory: *[Signature]*

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Comparison of Sludge before and after Bio-remediation



Oil & Grease percentage: 9.12



Oil & Grease percentage: 1.40

OBSERVATIONS

1. It was observed that, SOLPAR is very effective in vapour suppression. The pungent smell of the sludge disappeared within two days, after the 1st treatment.
2. The sludge which was sloppy and sticky before the treatment has turned brittle and the lumps have become breakable by the 2nd treatment.
3. The thick dark colour of the sludge was transformed to light grey colour within 3 weeks. By the end of the treatment process, the colour was changed to brownish yellow, similar to that of fresh sandy soil.
4. No bacterial cultures and microbes were used in this process. The Bioremediation of the low oil content sludge has been successfully and effectively accomplished with the natural bacteria on site.
5. The permeability and porosity of the remediated sludge were akin to that of soil.
6. The efficacy of SOLPAR was proved for its effectiveness of product sludge.
7. This method is very economical for treatment and disposal of petroleum sludge.